

REMARKS

1. Claims 1-17 are now pending. Claims 14 and 17 have been added.
2. Claim 12 stands rejected under 35 USC Section 12, first paragraph, because it is not described in the specification. According to the Examiner, "There is no support for the endpoint of 90% by weight of the epoxy (a) in the epoxy resin. Examples 1 and 6 contain 91.8% by weight epoxy (a), examples 2-4 contain 96% epoxy (a) and examples 5 and 7 contain 79% epoxy resin (a)." Final Office Action, page 2.

Claim 12, as currently amended, now encompasses a range of resins that are clearly described in the specification by Examples. See specification, paragraphs [0042], [0046], [0046 and [0048]. Applicants respectfully request that currently amended claim 12 be made of record and be found in condition for allowance.

3. Support for newly added claim 14-17 can be found in the specification, e.g. Support for:

Claim 14 can be found in Examples 1 and 6 paragraphs [0042] and [0047].

Claim 15 can be found in Examples 2-4 paragraphs [0043] - [0045].

Claim 16 can be found in Examples 5 and 7 paragraphs [0046] and [0048].

Claim 17 can be found in Examples 5 and 7 (for the lower limit of the claimed range) and Examples 2-4 (for the higher limit of the claimed range).

Applicants respectfully request that newly added claims 12-17 be entered into the record and found to be in condition for allowance.

4. The Final Office Action rejects Claims 1-13 under 35 U.S.C. §103(a) as being unpatentable over Arata *et al.* WO 00/37579 (applying U.S. Patent No. 6,558,797 to Arata *et al.* as its equivalent, hereinafter referred to as "Arata *et al.* '797") in view of GB 2,362,037 to Ongkosit ("Ongkosit '037") and further in view of JP 2000-154232 to Ekusa *et al.* ("Ekusa *et al.* '232"). The Action also dismisses the Applicants earlier filed arguments in support of the non-obviousness of claim 1-13 in view of the same set of references cited in the Final Office

Action as non-persuasive. The Applicants respectfully request that the Examiner reconsider the patentability of claims 1 and all claims that depend from Claim 1 (claim 2-17) in view of the following remarks.

Independent Claim 1 reads as follows:

1. An epoxy resin composition for a printed wiring board, comprising:
 - an epoxy resin, a phenol novolac resin and a curing accelerator,
 - said epoxy resin comprises an epoxy (a) and an epoxy (b), wherein the epoxy (a) is a brominated epoxy resin, obtainable by reacting/mixing a bisphenol A epoxy resin with tetrabromobisphenol A, said brominated epoxy resin having an epoxy equivalent of 350 g/eq to 470 g/eq and containing an n=0 component in a ratio of 20% to 35% in terms of area percentage in a GPC chart; and
 - the epoxy (b) is one or more of bifunctional epoxy resins, obtainable by reacting epichlorohydrin with any one selected from the group consisting of bisphenol A, bisphenol F and tetrabromobisphenol A, said bifunctional epoxy resins having an n=0 component in a content of 60% or higher in terms of area percentage in a GPC chart;
 - said epoxy (a) and epoxy (b) are contained in total in an amount of 80% to 100% by weight, based on the total weight of the epoxy resin composition;
 - said epoxy (a) is contained in an amount of 75% to 97% by weight, based on the total weight of the epoxy resin; and
 - said epoxy resin has a bromine content of 18% to 30% by weight, based on the total weight of the epoxy resin.

Claim 1 calls for an epoxy resin composition including first and second epoxy resins, namely, (i) a brominated epoxy resin (a) and (ii) a bifunctional epoxy resin (b). The brominated epoxy (a) has an epoxy equivalent of 350 g/eq to 470 g/eq. Further, brominated

epoxy (a) is contained in an amount of 75% to 97% by weight based and the total weight of brominated epoxy resin (a) and bifunctional epoxy resin (b).

The Examiner's rejection of independent Claim 1 including assertion still applicable and previously cited in the Non-Final Office Action mailed on August 18, 2009 appears to be based on all three of Arata *et al.* '797, Ekusa *et al.* '232, and Ongkosit '037, as follows:

According to the Examiner Arata *et al.* '797 discloses a composition including one or more epoxy resins, as well as a curing accelerator and a phenol novolac resin, namely, VH-4170 (col. 10, line 66).

The Examiner relies on Ekusa *et al.* '232 for disclosing a resin composition that includes both a brominated epoxy resin (A) and a non-brominated epoxy resin (B), and notes that the relative amount of the brominated epoxy resin (A) is between 20-80 wt. % of the total of the epoxy resins, which range overlaps the percent of the claimed content of the brominated epoxy (A) of 75% to 95% by weight, based on a total weight of the epoxy resins.

The Examiner relies on Ongkosit '037 for the disclosure of a brominated epoxy, namely, DER530A80, which has an epoxy equivalent of 427 g/eq and an N=0 component 28%, and correlates same to the claimed range for the epoxy equivalent of 350 g/eq to 470 g/eq and N=0 component in an ratio of 20% to 35% as called for in Claim 1 with respect to the brominated epoxy (A). Thus, it appears that the Examiner asserts that one of ordinary skill in the art would select the DER530A80 resin of Ongkosit '037 for use as the bromated epoxy resin (A) of Ekusa *et al.* '232.

For the reasons set forth below, Applicants respectfully submit that independent Claim 1 is not obvious based on the combination of references relied on by the Examiner. The combination of references taken together would not guide one of ordinary skill in the art, without knowledge of the present invention, to formulate a composition by selecting a brominated epoxy resin (a) having an epoxy equivalent within the relatively narrowly defined range of 350 g/eq to 470 g/eq, and using the brominated epoxy resin (a) together with a bifunctional epoxy resin (b) with brominated epoxy resin (a) being present in an amount of 75% to 97% based on the total weight of (a) and (b) to thereby arrive at an epoxy resin having a bromine content of 18% to 30% by weight, based on the total weight of (a) and (b).

Arata *et al.* '797 discloses a composition including "as essential components (a) an epoxy resin, (b) a polyfunctional phenol, (c) a curing accelerator ..., and (d) a compound

having a triazine ring or an isocyanuric ring" (col. 2, lines 11-14). The epoxy resin (a) includes one or more of the epoxy resins set forth at col. 2, lines 27-39.

In addition to element cited by the Examiner Arata *et al.* '797 teaches incorporating a halogenated epoxy resin into adhesive composition, " ... in order to make it flame-retardant..." Arata *et al.* '797, col. 5, lines 26-27. Arata *et al.* '797, also teaches limitation on the amount of halogenated resin that can be included in given formulation, reading as follows:

"Such a halide is used so that the halogen content will become 5 to 30 % by weight, preferably 10-10 % by weight, based on the total amount of the resins solid matters ((a), (b), and (d)) in said adhesive composition. A too low halogen content results in an unsatisfactory flame-retarding effect while too high halogen content tends to lower the glass transition temperature of the thermosetting composition." Id., Col. 5, Lines 45-52.

Claim 1 recites "[a] bromine content of 18% to 30% by weight, based on the total weight of the epoxy resin." This range of halogen recited in claim 1 is predominately outside of the preferred range of halogen content by Arata *et al.* '797. Accordingly one of ordinary skill in art with knowledge of Arata *et al.* '797, would not be inclined to formulate epoxy resins compositions that included this much bromine as they would likely exhibit poor, or at best, only marginal transition temperature. As stated in section 2141.02 IV of the MPEP, "A prior art reference must be considered in its entirety, i.e., as a whole, including portions that would lead away from the claimed invention. *W.L. Gore & Associates, Inc. v. Garlock, Inc.*, 721 F.2d 1540, 220 USPQ 303 (Fed. Cir. 1983), *cert. denied*, 469 U.S. 851 (1984)." When read in its entirety, Arata, *et al.*, would discourage one of ordinary skill in the art from formulating epoxy resins recited in Claim 1 of the instant application. The Applicants' invention composition includes levels of the bromine, which is a halogen, that are at the high end and predominately outside of the preferred range of halogen content taught by Arata *et al.* '797. Accordingly, it would not have been obvious to formulate and test the inventive compositions recited in Claim 1, in part because Arata *et al.*, teaches that there is only a marginal, at best, possibility of creating an epoxy based compound with useful properties.

Ekusa *et al.* '232 discloses a composition that includes three epoxy resins, namely:

(i) a brominated epoxy resin (A) having an epoxy equivalent between 200-700, present in an amount of 20-80 wt.% based on the total weight of the epoxy resins ([0008]); (ii) a non-brominated, bisphenol A type epoxy resin (B) present in an amount of 15-30 wt.%, based on the total weight of the epoxy resins ([0009]); and (iii) a novolac epoxy resin (C) present in an amount of 10-50 wt.% based on the total weight of the epoxy resins ([0010]). The Ekusa *et al.* '232 composition also includes tetrabromobisphenol A (not itself an epoxy resin) present in an amount of 20-50 wt.% based on the total weight of the epoxy resins (A), (B), and (C) ([0011]), and a dicyandiamide curing agent (E).

The Examiner relies on Ekusa *et al.* '232 for the disclosure that an epoxy composition may include both a brominated epoxy resin (*i.e.*, that of Ongkosit '037) and a non-brominated epoxy resin (*i.e.*, that of Arata *et al.* '797) and also relies on Ekusa *et al.* '232 for the relative amount of brominated epoxy resin that is present. Notably, as set forth above, the amount of the brominated epoxy used in the composition of Ekusa *et al.* '232 is 20-80 wt.% based on the total weight of the three epoxy resins in the Ekusa *et al.* '232 composition, namely, epoxies (A), (B), and (C).

By contrast, independent Claim 1 calls for the amount of the brominated epoxy (a) as being 75% to 97% based on a total weight of the epoxy resins. Although there is some overlap between these two ranges, the 20-80 wt. % range disclosed in Ekusa *et al.* '232 is broad in that it encompasses 60 percentage points, while the claimed range of 75% to 97% is much narrower in that it encompasses only 22 percentage points. Also, the claimed range actually overlaps the range of Ekusa *et al.* '232 by only 5 percentage points, and then diverges upwardly from the uppermost end of the range disclosed in Ekusa *et al.* '232, indicating a much higher content of brominated epoxy based on total epoxy resin content. In this manner, Ekusa *et al.* '232 fails to disclose brominated epoxy resin content with sufficient specificity to render the ranges recited in the Claim 1 obvious. One of ordinary skill in the art in possession of the disclosure of this reference would, in the absence of a non-obvious inventive step, have to engage in extensive experimentation in order to arrive at the Applicant's claimed and disclosed invention. A task made more implausible by the fact that the primary reference cited by Examiner explains that the amount of halogen in the claimed invention lies predominately outside of the preferred range taught by the reference.

Further, it is important to note that the Ekusa *et al.* '232 blend includes a third epoxy resin (C), namely, a novolak epoxy resin, in an amount of between 10 and 50% based on the total of the epoxy resins. Thus, if the minimum amount of 15 wt.% of the epoxy resin (B) is used together with the minimum amount of 10 wt.% of the epoxy resin (C) in the Ekusa *et al.* '232 blend, only 75 wt.% remains for the epoxy resin (A), which is at the lowest end of Applicants' claimed range.

Thus, without knowledge of the present invention, one of ordinary skill in the art, in relying on the relative proportions of the epoxy resins disclosed in Ekusa *et al.* '232, would not formulate an epoxy resin composition to include 75% to 97% of a brominated epoxy resin based on a total weight of the epoxy resins in the composition, as called for in independent Claim 1.

Additionally, the epoxy equivalent of 350 g/eq to 470 g/eq called for in independent Claim 1 for the brominated epoxy (a) is a relatively narrowly defined range within the much broader epoxy equivalent range of 200-700 disclosed for the brominated epoxy of Ekusa *et al.* '232. In this manner and similar to the above, Ekusa *et al.* '232 fails to disclose to one of ordinary skill in the art a brominated epoxy having an epoxy equivalent within a range that is disclosed with sufficient specificity to render obvious independent Claim 1.

Still further, independent Claim 1 calls for the epoxy resin to have a bromine content of 18% to 30%. Again, a relatively narrow range that the Examiner does not state would be met by a composition formulated based on the relative amounts of brominated epoxy resins and non-brominated epoxy resins disclosed by Ekusa *et al.* '232. In fact, given the relatively low amount of 20-80 wt.% of brominated epoxy resin (A) in the Ekusa *et al.* '232 composition as a percent of the total epoxy resin content as compared to the relatively greater claimed amount of 75% to 97% of brominated epoxy (A) as a percent of the total epoxy resin content, one of ordinary skill in the art, without knowledge of the present invention would have no teaching, guidance, or motivation to target the formulation of Ekusa *et al.* '232 such that the composition would have the claimed bromine content of 18% to 30% based on the weight of all epoxy resins.

By contrast, the Applicants have discovered that when an epoxy resin composition is formulated according to the particular parameters called for in independent Claim 1, such compositions may advantageously be used to form printed wiring board prepregs having a

good appearance, as well as an excellent combination of thermal decomposition temperature, heat resistance, fire retardancy, and glass transition temperature, as indicated in the Working Examples of the present application. The Applicants have also found that contrary to the teachings of Arata *et al.* '797, these compositions can be formulated to include levels of the halogen (bromine) that lies predominately within a range of values that Arata *et al.* '797 teaches is disfavored.

Even in possession of the teaching of the three references cited by the Examiner, arriving at the particular ranges of prepreg components invented by the Applicants, recited in Claim 1, and found to form good prepreps would require excessive experimentation, as there is nothing in the art cited by the Examiner suggesting that this range would work as well as it does. Accordingly, Claim 1 is not obvious over the combination of references cited by the Examiner or reasonable inferences made there from.

For the foregoing reasons, Applicants respectfully submit that independent Claim 1 is not obvious over Arata *et al.* '797 in combination with Ekusa *et al.* '232 and Ongkosit '037. Applicants respectfully request the rejection of Claim 1 be removed and that Claim 1 and all Claims that depend from Claim 1 be found in condition of allowance.

5. Remarks on Claims 12, 13-17.

Currently amended Claim 12 calls for the brominated epoxy resin (a) to be contained in an amount of 91.8% to 96% by weight, based on the total weight of the epoxy resin, as in Examples 1-7 of the present application as it was filed in paragraphs [0042] – [0048].

Claim 13 calls for the brominated epoxy resin (a) to have an epoxy equivalent of 427 g/eq to 470 g/eq, as set forth in paragraph [0035] and in Examples 1-7 of the present application as it was filed. Claim 13 calls for a still narrower epoxy equivalent range for the brominated epoxy (a), namely, 427 g/eq to 470 g/eq.

New claims 14-17 call for amounts of brominated epoxy resins exemplified in the specification at paragraphs [0042] – [0048].

These claims recite ranges of component that are narrower than the ranges of the same components cited in Claim 1 and these ranges like the ranges cited in Claim 1 from which they depend are not obvious over the art cited in the Instant Final Office Action and the prior issued Non-Final Office Action.

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It is believed that the above represents a complete response to rejections listed in the Final Official Action and provides evidence of support for the patentability of new Claims 14-17 included herein. To that end, reconsideration is requested. Specifically, Applicants respectfully submit that the claims of the Request for Continued Examination filed herewith are in condition for allowance and respectfully request allowance thereof.

In the event Applicants have overlooked the need for an additional extension of time, payment of fee, or additional payment of fee, Applicants hereby petition therefor and authorize that any charges be made to Deposit Account No. 02-0390, Baker & Daniels LLP.

Should the Examiner have any further questions regarding any of the foregoing, the Examiner is respectfully invited to telephone the undersigned at 317-237-0300.

Respectfully submitted,

John J. Emanuele
Registration No. 51,653
Attorney for Applicants

JJE:ksg

BAKER & DANIELS LLP
300 N. Meridian Street, Suite 2700
Indianapolis, Indiana 46204
Telephone: 317-237-0300
Facsimile: 317-237-1000

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July 16, 2010

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